

Accuracy of photometric stereo estimated with textured calibration samples

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Colour appearance in object imaging depends upon several factors: imaging device and geometry, lighting conditions and the object itself. When dealing with textured objects these factors become critical (e.g. keeping fix the position of the camera and the object, the colour appearance of the object changes if we change the direction of illumination) and can be a problem for object characterization. Photometric stereo methods have been used for number of years and allow recovering normal vectors and albedo (Barsky and Petrou, 2003, IEEE Transactions on Pattern Analysis and Machine Intelligence, 25(10), 1234-1252), a quantity that has long been used in computer graphics to characterize textured surfaces. However, the evaluation of the accuracy of such a system is a difficult task. We introduced a calibration method where a set of seven samples of different colours are used. Each sample is composed by five chips made with the same material (polymer clay) and having the same colour. One of the chips is flat, and each of the other four is made of different textures. Within each calibration sample, albedo recovered from the flat sample is used as reference, since in this case the absence of textures allows obtaining a perfectly smooth albedo, and the albedo recovered from the four samples are compared with the reference. This method was used to compare albedos recovered using two alternative algorithms: one which does not correct for highlights or shadows and one which compensates for these factors. It was found that correcting for highlights and shadows lead to an improvement of about 50% in the accuracy of the recovering procedure thereby making technique suitable for visual applications.

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